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THE PEREGRINE FALCON (*Falco peregrinus macropus*) Swainson IN SOUTHEASTERN QUEENSLAND

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ABSTRACT - Most studies of Peregrine Falcon (*Falco peregrinus*) biology have been conducted in Europe and North America (Hickey and Anderson 1969; Ratcliffe 1980; Cade 1982). Information concerning southern hemisphere Peregrines is restricted to the studies of Clunie (1972, 1976) on Fiji, reviews by Cade (1969), Brown (1970) and Steyn (1982) of African populations, while Chaffer (1944), Jones and Bren (1978), Norris et al. (1977), Olsen and Olsen (1979), Olsen et al. (1979), Olsen (1982), Pruett-Jones et al. (1981 a, b), Walsh (1978) and White et al. (1981) provide important contributions for Australia.

Declines in some northern hemisphere populations due to the effects of pesticides (Hickey 1969; Bijleveld 1974; Newton 1979; Ratcliffe 1980; Cade 1982) have served to focus considerable attention on the distribution and dynamics of regional Peregrine Falcon (*Falco peregrinus*) populations. Concern has been expressed about the potential affects of pesticides on populations of this falcon within Australia (Olsen and Olsen 1979, 1981; Pruett-Jones et al. 1981b). Existing studies on the status of the peregrine within Australia have been conducted in the southeastern corner of the continent (Olsen and Olsen in press) and little is known of the status of northern and western populations. The following reviews the present state of knowledge of the peregrine in southeast Queensland. A more detailed, long-term study is underway.

MATERIALS AND METHODS

Information for this review was obtained from Queensland Museum records, literature, and previously unpublished observations of both myself (1968 to present) and others. Geographic units referred to as southeastern Queensland and Moreton and Wide Bay — Burnett region follow Roberts (1979) and Mather (1976), respectively. Note that a bias toward the Moreton region exists - reflecting distribution of observers. Sufficient information is available for the presentation of a broad outline of distribution, breeding, hunting and conservation problems of peregrines over southeastern Queensland as a whole. Vegetation terminology follows Groves (1981).

DISTRIBUTION.

Peregrine Falcons have been recorded over much of southeastern Queensland (Fig. 1; Table 1). In addition, they have been recorded in the im-

mediate vicinity of the regional boundary (Broadbent 1889; Barnard and Barnard 1925; Longmore 1978; Passmore 1982). Vegetation type appears to exert little or no influence on the overall distribution here, as closed-forests, open-forests, woodlands, wetlands and agricultural areas are all frequented by falcons. For example, Dwyer et al. (1979) recorded peregrines from 8 of 12 habitat types found across Cooloola. The vegetation types represented here included vine forest, various forms of open forest and woodland as well as heath, herb and sedgeland. Wide occupation of vegetation types has been noted also in the Rockhampton area to the north (Longmore 1978).

Vernon (1976) and Roberts (1979) both note that peregrines favour mountainous areas with extensive cliffs and rocky outcrops. Examination of records used to construct Fig. 1 indicates that this is essentially correct with some modification. Certainly peregrines are well represented in mountainous areas as they have been seen on 11 of the 14 major mountain systems. However, they are also frequently observed in coastal districts where they may be locally abundant (Cooloola; Roberts and Ingram 1976). Examination of inland localities where peregrines are regularly encountered indicates an association with cliffs, gorges, and outcrops. Similarly, coastal records involve areas where eroded high dunes/coastal cliffs (Fraser, Moreton and North Stradbroke Islands), subcoastal highlands (MacPherson Range-Gold Coast) or isolated peaks (Mt. Cooroy-Peregrin, Pumicestone Passage - Glasshouse Mountains) are found nearby.



Figure 1. Distribution of *Falco peregrinus macropus* in southeastern Queensland based on both published and unpublished sightings.

BREEDING, DENSITY AND MOVEMENTS

Twenty-four active eyries (eggs and/or adults plus young present) are known from southeastern Queensland. In addition, several areas containing suspected eyries have yet to be examined and 1 eyrie previously known to be active was inactive. Most eyries were located within major range systems although 6 outlying sites are known. With the exception of 1 eyrie located on a high coastal foredune, vertical or subvertical rock faces along exposed cliffs or along gorges were utilized. Rock faces were variously composed of granite, trachyte, basalt or sandstone. The dune nest was situated on exposed sandrock-fossil hardpan. Individual eyries were placed on ledges, crevices or shallow caves (Fig. 2 A,B) between 30-270 m above ground level. The surrounding vegetation was either subtropical rainforest, open-forest or woodland.

Most eyries appeared to have been active for some time. One located within the northern Moreton region was active since the early 1940's, although peregrine records within this area indicate at least 50 yr occupation of the site. Activity as-

sociated with another Moreton region eyries indicates that it has been active for about 60 yr. The earliest records available for the southern Moreton region are from the early 1940's, and mid-1950's for the western Moreton region. Only very recent records are available for the Wide Bay-Burnett region.

Observations made within the northern Moreton region suggest that breeding starts mid-August or early September. Beruldsen (1980) records a nesting season of "July to October, sometimes November in the south, and April to June in the north". The earliest known egg-laying occurred in late July (1980) and the latest early November (1968). The latter cases appears somewhat anomalous and may represent either a late breeding or a replacement clutch. Display was noted during October and 2 fledglings were present during December. Little activity had been detected during September of that year. Pre-egg-laying display flights were typical of those used by peregrines elsewhere and consists of mixtures of components such as High-circling, Figure-of-eight, Flight-rolling and Z-flight (Cramp and Simmons 1980;

Table 1. Summary of available published sightings of Peregrine Falcons in Southeastern Queensland.

LOCALITY	SOURCE
Callide Dam	Zillman 1974
Sandy Cape	Makin 1968
Fraser Island	Vernon and Barry 1972
Mt. Walsh	Frauca 1970
Maryborough	Anon. 1972, Jones 1981
Auburn River	<i>Darling Downs Naturalist</i> Dec. 1978:43*
Cooloola	Roderick 1975, Roberts and Ingram 1976; Dwyer et al. 1977
Teewah Creek	Ingram 1972
Noosa Heads	Wheeler 1959 (probable)
Jimna	Q.O.S. July 1978:2*
Kilcoy Shire	McEvoy et al. 1979
Blackall Range	Czechura in press
Maleny	Czechura 1970, Q.O.S. Jan. 1975:2
Conondale Range	Roberts 1977; Czechura in press
Glasshouse Mountains	Jack 1941; Fien 1966; MacArthur 1978
Pumicestone Passage	Mayo 1934; MacArthur 1978
Redcliffe	Q.O.S. May 1974:3
Crows Nest	Q.O.S. Oct. 1977:3
D'Aguilar Range	Illidge 1923; Vernon 1976
Pinkenba	Q.O.S. Nov. 1982:4
Lytton	Q.O.S. Nov. 1982:2
Bardon	a.S. May 1974:3
Stones Corner	Q.O.S. Nov. 1982:2
Murphy's Creek	Lord 1956
Pt. Lookout	Q.O.S. May 1977:4
North Stradbroke Is.	Vernon and Martin 1975
Cecil Plains	Q.O.S. June 1979:2
Cooper's Plains	Q.O.S. March 1976:3
Redwood Park	Q.O.S. July 1978:3
Cunningham's Gap	Vernon 1976
Dalrymple Ck.	Q.O.S. June 1977:2
Tweed R. District	Keast 1944
Warwick district	Kirkpatrick 1967
Emuval	Q.O.S. Sept. 1977:2
Stanthorpe	Passmore 1982
Lamington N.P.	Robertson 1948
Binna Burra	Wheeler 1973; Q.O.S. July 1979:4

* Newsletters are cited in table only. 'Q.O.S.' refers to Queensland Ornithological Society Newsletter.

Monneret 1974; Ratcliffe 1980). In addition, a flight termed herein the V-flight, has been observed in which a circling or flying peregrine suddenly stoops with wings closed, terminates the stoop by spreading its wings and regains altitude using a combination of momentum and flapping flight

(Fig. 3). The speed at which the stoop is terminated and altitude regained often leaves the impression of a stoop followed by a 'bounce'. The V-flight usually followed a period of High-circling, linear flight or undirected activity. Several flights may be conducted in quick succession. All display flights were

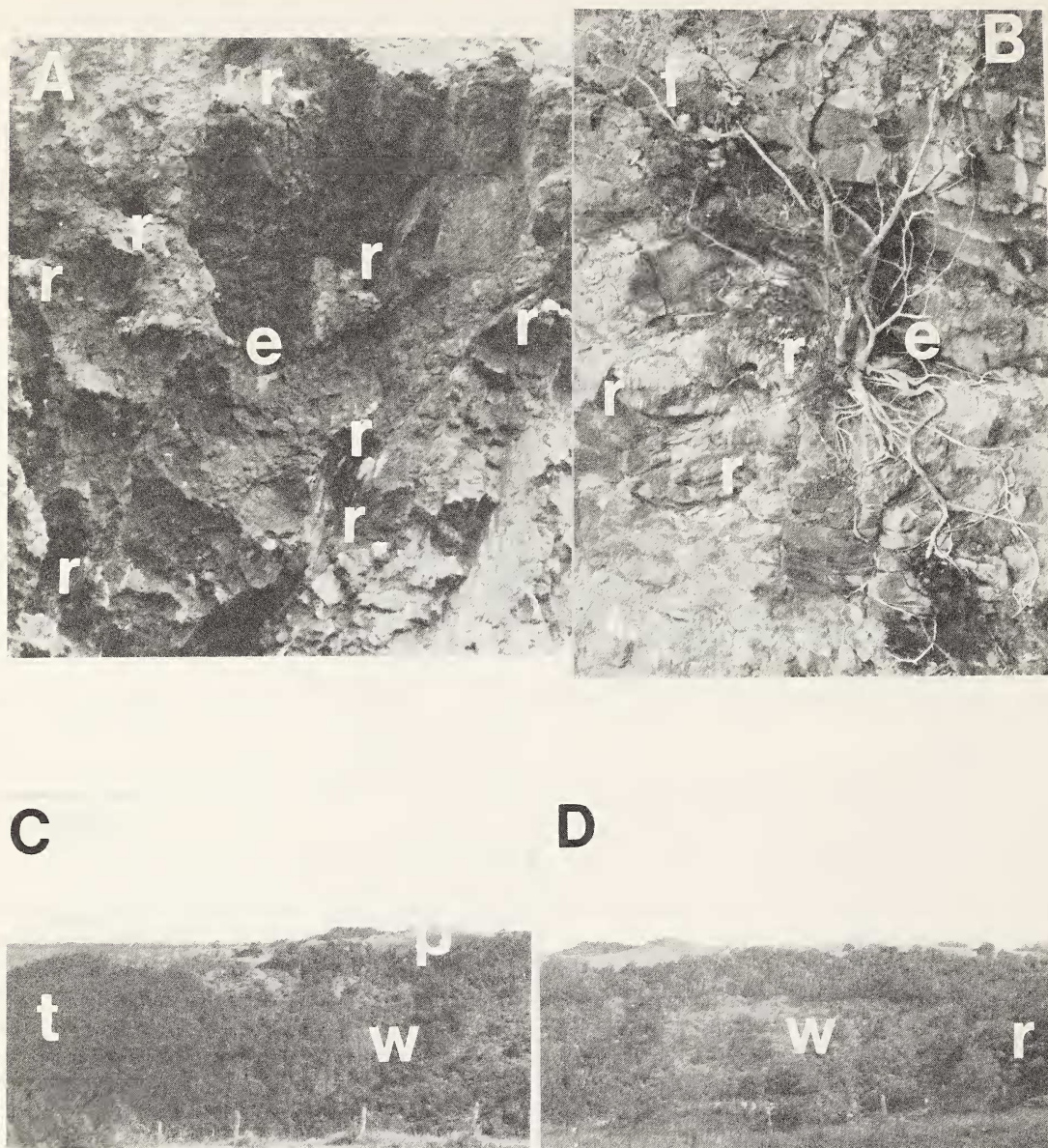


Figure 2: A. Ledge eyrie (e), eastern Moreton region; adjacent roosts (r) are also indicated. B. Cave eyrie (2), eastern Moreton region; perched peregrine (1) and adjacent roosts are indicated. The location of this eyrie is shown by its entrance. C-D. Peregrine hunting area (approx. 4 km SW Maleny). This area has been regularly used since 1970. Note different vegetation types present (r-rainforest, t-tall open-forest, p-pasture, w-regrowth).

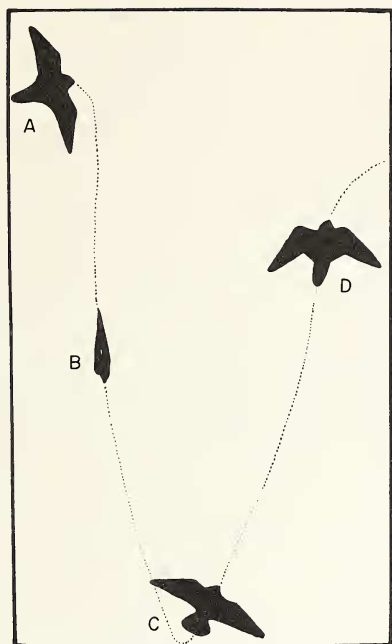


Figure 3. The 'V-flight' display. The display commences (A) from earlier circling or similar activity. The falcon abruptly stoops with wings closed (B), terminates the flight (C) by spreading the wings and regains altitude (D) using momentum and later flapping flight.

accompanied by much vocalization. Copulation usually occurred late during the display period and on areas surrounding the nest (ledges, projections of the cliff-face or adjacent trees).

Little information is available concerning clutch size. P. Olsen (pers. comm.) has examined 3 clutches (1 questionably from southeastern Queensland). All consisted of 3 eggs. Indirect evidence, such as the number of fledglings at active eyries, suggests that a clutch size of 3 is usual (G. Geruldsen pers. comm.; pers. obs.). Typically 2 young fledge (Table 2). The maximum number of fledglings observed at a number of sites is 3 (pers. obs.; P. Slater pers. comm.; D. Evans pers. comm.) suggesting either high productivity or occasional larger clutches. Olsen and Olsen (1979) record a mean clutch size for Queensland peregrines of 2.5 pre-1947 and 3.1 post-1947. Savidge (in Mathews 1916) records cliff-face nesting in the Clarence River district of northeastern New South Wales and collected the following successive clutches from 1 pair

of falcons; 16 August, 3 eggs; 13 September, 3 eggs; 14 October, 2 eggs.

Data from southeastern Queensland appear consistent with similar data from southeastern Australia. The presumed clutch size of 3 in southeastern Queensland compares favourably with both the State means (above) and the combined means for New South Wales, Victoria, South Australia and Tasmania (pre-1947, 3.0; post-1947, 2.7; data from Olsen and Olsen 1979). Olsen (1982) did not find any significant correlation between clutch size and latitude, longitude or temperature. Similarly, comparison of the mean numbers of fledglings of the 2 Moreton region eyries (2.13, 2.25; Table 2) indicates that these values are within the range for numbers of young at successful eyries in New South Wales (2.2), Victoria (2.1), South Australia (2.2) and Tasmania (2.5) (data from Pruett-Jones et al. 1981; Olsen and Olsen in press).

Pending the completion of survey work currently in progress, only approximate values of peregrine density over the entire region are available. Estimates, based on known pairs in the Moreton region, indicate a density of about 1 pair/2600 km², while taking suspected pairs into consideration a value of 1 pair/1500 km² is suggested. These values com-

Table 2: Fledgling number at 2 adjacent northern Moreton Region Eyries 1968 - 1982.

YEAR	NUMBERS OF FLEDGLINGS OBSERVED	
	EYRIE A	EYRIE B
1968	2	*
1969	2	*
1970	3	*
1972	3	*
1976	2	*
1977	1	*
1979	2	2
1980	*	3
1981	*	2
1982	2	2
Mean	2.13	2.25

* - No data available

pare with a density of 1 pair/100 km² for one area under study. Distances between neighboring eyries range from 4.8 - 65 km (mean 40.9, N = 221 km). The above density values are tentative. This uncertainty reflects the difficulty in locating alternate nesting sites (e.g., stick nests) in dense forest (rain-forest, tall open-forest) and poor accessibility to some highland areas supporting suitable cliff faces. The current estimates indicate a nesting density well below that of Victoria (1 pair/600 - 800 km², White et al. 1981) and slightly higher than Tasmania (Olsen and Olsen in press).

Storr (1983) considers *F. p. macropus* to be nomadic and evidently migratory over much of Queensland. He noted that most records involved

the period April-October. Monthly observations at several more accessible Moreton region eyries strongly suggested that breeding birds are relatively sedentary with roosts being maintained around the eyrie outside the breeding season. Observations made by Jones and Bren (1978) and Olsen and Olsen (in press) indicate the same in southeastern Australia. Hunting is less frequent but conducted over much the same area as used during the breeding season. In general, it seems that the apparent nomadism of peregrines may be attributable to the inconspicuousness of adults around eyries outside the breeding season and movements of immature birds. Locally high densities have been reported (Elks in Roberts and

Table 3. Prey recorded for the Peregrine Falcon (*Falco peregrinus macropus*) in Southeastern Queensland.

PREY ITEMS	SOURCE
Insects	
Orthoptera	P. Slater pers. comm.
Odonata	Pers. obs.
Birds	
Prion (<i>Pachyptila</i> sp.)	C. Corben pers. comm.
Cormorants (<i>Phalacrocorax</i> spp.)	Mayo 1934
Sacred Ibis (<i>Threskiornis aethiopicus</i>)	Czechura 1971, pers. obs.
Black Duck (<i>Anas superciliosa</i>)	R. Lutkins pers. comm.
Grey Teal (<i>Anas gibberifrons</i>)	R. Lutkins pers. comm.
Australian Kestrel (<i>Falco cenchroides</i>)	B. Cowell and G. Czechura obs. ¹
Stubble Quail (<i>Coturnix novaezelandiae</i>)	Czechura 1979
Brown Quail (<i>Coturnix australis</i>)	Czechura 1979
Red-kneed Dotterel (<i>Erythronyx cinctus</i>)	G. Roberts pers. comm.
Red-necked Stint (<i>Calidris ruficollis</i>)	C. Corben and G. Czechura obs.
Feral Pigeon (<i>Columba livia</i>)	C. Corben pers. comm., D. Evans pers. comm.
Crested Pigeon (<i>Ocyphaps lophotes</i>)	P. Veerman pers. comm.
Bar-shouldered Dove (<i>Geopelia humeralis</i>)	pers. obs.
Rainbow Lorikeet (<i>Trichoglossus haematodus</i>)	pers. obs., D. Evans pers comm., C. Corben pers. comm.
Scaly-breasted Lorrikeet (<i>Trichoglossus chlorolepidotus</i>)	pers. obs. ¹ , D. Evans pers. comm.
Pale-headed Rosella (<i>Platycercus adscitus</i>)	Prey remains at eyrie
White-throated Needle-tail (<i>Hirundapus caudacutus</i>)	G. & R. Czechura obs. ¹
Black-faced Cuckoo-shrike (<i>Coracina novaehollandiae</i>)	pers. obs.
Lewin Honeyeater (<i>Meliphaga lewinii</i>)	pers. obs. ¹
Noisy Friar-bird (<i>Philemon corniculatus</i>)	pers. obs. ¹
Noisy Miner (<i>Manorina melanocephala</i>)	pers. obs. ¹
Yellow-faced Honeyeater (<i>Lichenostomus chrysops</i>)	pers. obs.
Common Starling (<i>Sturnus vulgaris</i>)	pers. obs. ¹

¹ Includes observations made at eyrie during breeding season.

Ingram 1976) but as with most reports, it is not known if these involve adults or immatures. Immatures once independent, rarely remain in the vicinity of the eyrie for longer than 4 - 8 weeks approximately, although lone birds may take up residence in areas rarely frequented by the adults (pers. obs.). Otherwise little is known of movements or fate of the majority of immature birds.

Hunting and Prey - Peregrines were observed hunting in a variety of habitat and landscape types. Some regularly hunted over both very open (mudflats, waterways, pastureland) and densely vegetated (rainforest, tall open-forest, heathland) areas (Fig. 2 C, D). Presumably, hunting areas were determined by the location of nesting sites.

Prior to the advent of European settlement in southeastern Queensland, peregrines were largely associated with forested habitats. Rainforest vegetation was more extensive in coastal and subcoastal districts than at present (Illidge 1925; Francis 1970). Indeed, Cade (1982) noted that Australian populations of *F. peregrinus* show modifications of the feet and beak typical of "forest" races of the peregrine, *F. p. peregrinator* (India), *F. p. ernesti* (New Guinea) and *F. p. nesiotis* (Fiji) and the two large, forest-dwelling species, Orange-breasted Falcon (*Falco deiroleucus*) and New Zealand Falcon (*Falco novaeseelandiae*). Similarly, Pruett-Jones et al. (1981a) have commented on modifications of hunting techniques for dense woodland and forests in Victoria.

Birds were the chief prey (Table 3). Brief descriptions of some hunting flights are given by Mayo (1934) and Czechura (1970, 1971). Comparison of published and unpublished observations with the descriptions of Treleaven (1977), Ratcliffe (1980) and Cade (1982) indicate most hunting consists of a period of "still hunting" or "waiting on" followed by the traditional stoop or direct pursuit. "Still hunting" (Fig. 4-1A) involves the falcon launching an attack from a perch, such as an emergent tree in rainforest, on passing birds. On leaving the perch, the peregrine either gained altitude and then stooped onto the prey, made a level dash towards it (Mayo 1934; Czechura 1971) or stooped directly onto it. "Waiting On" (Fig. 4-1B) involves the raptor initially spending some time circling and/or engaged in active flight before stooping. The actual stoop (Fig. 4-2B) is usually conducted with wings closed or partly closed in a rather shallow angle of attack. The final stages of the stoop

may result in complex aerial manoeuvres as prey attempts to evade the falcon (Fig. 4-1B). Once the prey is struck by the peregrine, a loop may be performed to retrieve the body (Fig. 4-2B) or the bird may be simply seized and carried. Direct pursuit usually culminates in the peregrine seizing the prey.

Under special circumstances other hunting techniques were employed. "Solitary flushing" may be employed against ground-dwelling quail (Czechura 1979). The peregrine will make rapid, low-level passes above the vegetation sheltering the quail. If quail flush, direct pursuit will result. Peregrines, at other times, will "hawk" flying insects by leisurely circling amongst the insects and snatching them out of the air or snatch birds sheltering on the ground as they pass overhead, e.g., waders on mudflats.

It is difficult to determine hunting efficiency of peregrines. On many occasions a falcon will indulge in numerous attacks for up to an hour before a successful kill is made. Many attacks, however, do not appear to be pressed with determination (low intensity attacks, Treleaven 1977) e.g., the falcon breaks off early, stoops are short and relatively slow. During such times, and sometimes after feeding, "playful" attacks are made on large birds such as ibis (*Threskiornis* spp.) and Torresian Crow (*Corvus orru*). Under the circumstances, lone crows or ibises are stooped on, with the peregrine often looping around the intended victim and then flying away. Similarly, flocks may be attacked with the apparent objective of breaking them up into smaller units. Bouts of such playful behaviour are interspersed with periods of soaring, slow flying and perching. Attacks on flocks of birds are usually unsuccessful if the flocks maintain their structure (Fig. 4-1C). Lone birds that attempt to leave the flock often are very quickly captured (Fig. 4-2C). Fruit pigeons and lorikeets will often attempt to out-maneuvre the falcon and seek shelter in the canopy of nearby trees by perching or flying through them. Frith (1942) reported such behaviour among fruit pigeons in northern New South Wales but notes one case where the pursuing peregrine pressed its attack below the forest canopy. While successful attacks have been observed on lorikeets (*Trichoglossus* spp.) and honeyeaters, no successful attacks have been reported on either Topnot Pigeon (*Lopholaimus antarcticus*) or White-headed Pigeon (*Columba leucomela*) flocks.

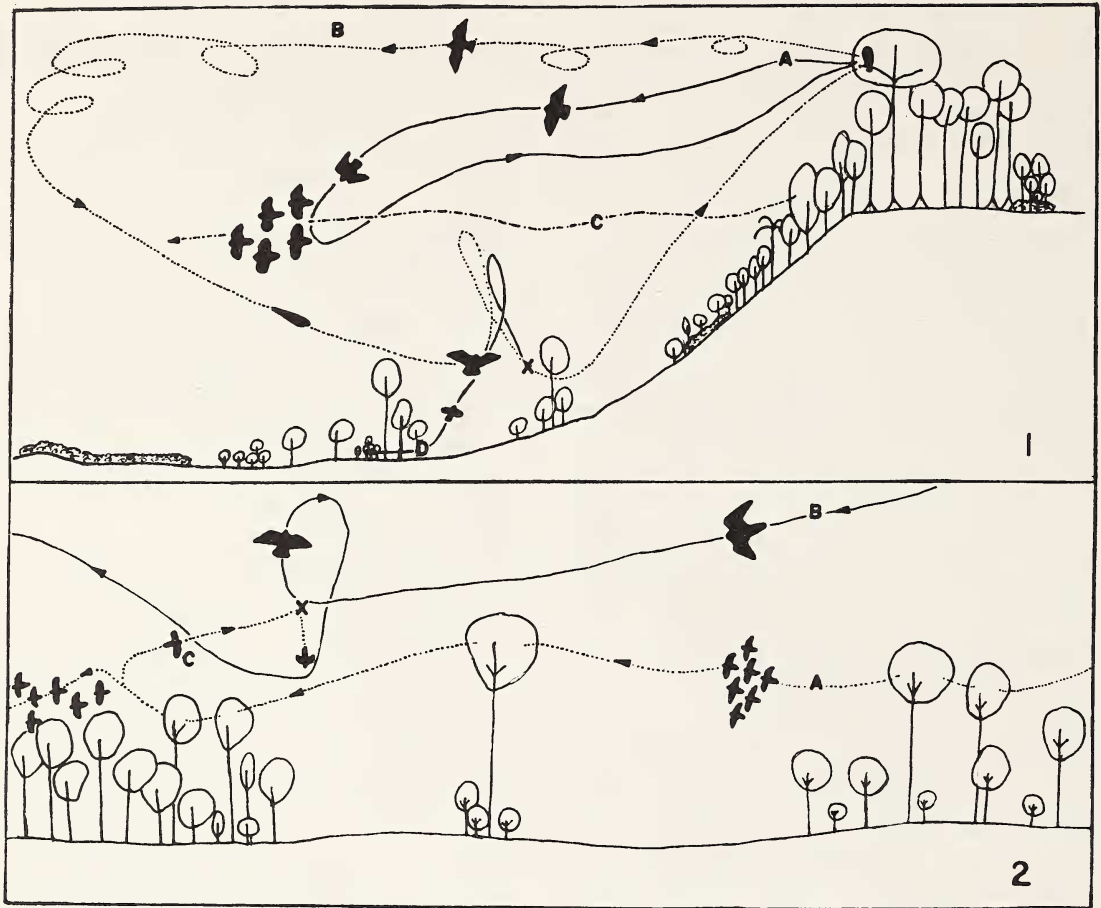


Figure 4. Peregrine Falcon (*Falco peregrinus*) hunting behavior.

- 4.1 Hunting over rainforest and pasture-regrowth area near Maleny (profile taken from transect across part of the hunting area shown in Plate 1 C-D). A. Unsuccessful (?low intensity) attack on a flock of Topknot Pigeons (flight path C) leaving rainforest canopy. The adult female peregrine was perched in an emergent *Ficus* sp. and returned after this attack. B. Successful attack on an unidentified honey-eater (D) after a period of soaring. The honeyeater attempted to climb, then dive away from the falcon prior to its capture (x). Plucking and feeding was conducted on the perch atop the emergent *Ficus* sp. This attack was conducted approximately 15 mins after attack A.
- 4.2 Successful hunt over woodland - pasture - low riverine rainforest near Woodford. A. Feeding flock of lorikeets were attacked by an adult female peregrine (B) after leaving the central tree. The flock, except one bird (C) fled through the canopy of adjacent trees. Bird C was struck by the falcon, caught after a rapid loop, then carried.

Although very little is known of hunting and prey species of peregrines in the region during early settlement, observations made by Savidge (*in* Matthews 1916) in the Clarence River district of north-eastern New South Wales suggest little change has taken place. Savidge records the following prey, Black Duck (*Anas superciliosa*), Rainbow Lorikeet (*Trichoglossus haematodus*), Pale-headed Rosella (*Platycercus absconditus*), Australian Magpie-lark (*Gralina cyanoleuca*) Feral Pigeon (*Columba livia*) and Feral Chicken (*Gallus gallus*). All but *G. cyanoleuca* and *G. gallus* have been recorded among prey from southeastern Queensland (Table 3).

Interactions with Other Raptors - Interaction between the Australian Hobbie (*Falco longipennis*) and peregrines occur in many areas with the exception of heavily timbered and some upland areas (Czechura *in press*). Both falcons may be found hunting in the same areas on occasion (e.g., Woodford, Caboolture), especially when lorikeets are abundant. At these times peregrines largely hunt the Rainbow Lorikeet (*Trichoglossus haematodus*) and Scaly-breasted Lorikeet (*Trichoglossus chlorolepidotus*), while Australian hobbies hunt *T. chlorolepidotus* and the smaller Little Lorikeet (*Glossopsitta pusilla*). The Brown Falcon (*Falco berigora*) occurs with peregrines in many areas with the exception of densely timbered country. Interactions between Brown and Peregrine Falcons appear to be mildly aggressive. Brown Falcons will often leave hunting areas after the appearance of peregrines. At other times peregrines may make 1 or 2 casual stoops at flying Brown Falcons or Brown Falcons may stoop at perched peregrines. The Australian Kestrel (*Falco tinnunculus*) comes into contact with peregrines in the same habitats as Brown Falcons. Kestrels readily mob perched peregrines, while Czechura (1970) has reported a possible 'play' encounter. On one occasion a kestrel was among prey brought to an eyrie (Table 3).

Peregrines have been observed mobbing the Whistling Kite (*Haliastur sphenurus*) on 2 occasions along Pumicestone Passage. Both of these involved the same immature female peregrine. Otherwise observations are restricted to encounters near eyries. On several occasions the Wedge-tailed Eagle (*Aquila audax*) and once a Grey Goshawk (*Accipiter novaehollandiae*) were mobbed by one or both falcons as they approached eyries.

Mortality and Conservation - Little is known of natural mortality among peregrines in southeast-

ern Queensland, although one was found dead after a hailstorm in the Brisbane area (Q.M. ornithological records). The most significant cause of mortality appears to be human persecution. Pigeon fanciers have destroyed adults and interfered with eyries in the eastern Moreton region. Some falcons certainly fall victim to general persecution of raptors. Disturbance at eyries also results from sightseers, bushwackers and illegal egg-collectors.

The nature and extent of pesticide effects within the region are poorly known. Olsen and Olsen (1979) found greater than 20% eggshell thinning attributable to D.D.T. in clutches from southeastern Queensland; this compares with a State mean of 3.6%. Shell thinning of 15-20% is critical - affected eggs would not be expected to withstand incubation (Newton 1979; Ratcliffe 1980). No peregrines have come to the Small Animal Clinic, Department of Veterinary Science, University of Queensland, suffering from pesticide poisoning (W. Rooke pers. comm.), but the Clinic has received other diurnal raptors suffering from pesticide poisoning.

Some recent developments in the patterns of pesticide use in southeastern Queensland are of concern. *Heliothis* moths are serious crop pests (Broadley 1977) and recent failure of a number of synthetic pyrethrins used in their control has led to renewed use of organochlorines in a number of areas, while serious outbreaks of armyworms (*Pseudaletia* spp., *Spodoptera* sp.; Broadley 1978, 1979) in southern subcoastal pasturelands have necessitated use of pesticides (particularly via aerial application), where their usage has traditionally been of a low level.

Although a number of eyries are within the existing national park-reserve system, there are no specific conservation/management programmes in operation. The species is protected under the provisions of the Fauna Conservation Act of 1974.

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Attention RRF Members Past and Present!! The Raptor Research Foundation, Inc., is approaching its 20th Anniversary. In honor of this memorable occasion, I am compiling a twenty-year history of the Foundation to be presented in Sacramento at the 1985 annual meeting. In addition, plans are to compose a monograph detailing the Foundation's history from beginning to present. I request the assistance of you, the membership, both past and present, in accomplishing this task. Please contact me if you have any pertinent information in your files, such as photographs, correspondence, etc., that you would be willing to loan to me. All such material will be acknowledged in publications, of course, and I will make copies of the materials for my use and return the originals immediately. If you have anything you wish to contribute, please contact me as follows: Jimmie R. Parrish, Department of Zoology, 159 WIDB, Brigham Young University, Provo, Utah 84602, USA.